

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

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PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/EP2004/003111

International filing date (day/month/year)
24.03.2004

Priority date (day/month/year)
28.03.2003

International Patent Classification (IPC) or both national classification and IPC
H01L51/20

Applicant
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1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☒ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:



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**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**International application No.
PCT/EP2004/003111

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
☐ a sequence listing
☐ table(s) related to the sequence listing
 - b. format of material:
☐ in written format
☐ in computer readable form
 - c. time of filing/furnishing:
☐ contained in the international application as filed.
☐ filed together with the international application in computer readable form.
☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/EP2004/003111

Box No. II Priority

1. ☒ The following document has not been furnished:

- ☒ copy of the earlier application whose priority has been claimed (Rule 43*bis*.1 and 66.7(a)).
- ☐ translation of the earlier application whose priority has been claimed (Rule 43*bis*.1 and 66.7(b)).

Consequently it has not been possible to consider the validity of the priority claim. This opinion has nevertheless been established on the assumption that the relevant date is the claimed priority date.

2. ☐ This opinion has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rules 43*bis*.1 and 64.1). Thus for the purposes of this opinion, the international filing date indicated above is considered to be the relevant date.

3. Additional observations, if necessary:

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	8,10,11-16,19,20
	No: Claims	1-7,9,17,18,21-28
Inventive step (IS)	Yes: Claims	11
	No: Claims	8,10,12,13,14,15,16,19,20
Industrial applicability (IA)	Yes: Claims	1-28
	No: Claims	

2. Citations and explanations

see separate sheet

Re Item V.

1. The following documents are referred to in this communication:

D1a : PATENT ABSTRACTS OF JAPAN vol. 2002, no. 10, 10 October 2002

D1b: JP 2002 164166 A (CANON INC), 7 June 2002, corresponding japanese patent application of D1a

D2 : WO 02/102117 A (PARK BYOUNG CHOO) 19 December 2002

D3 : WO 01/01452 A (PENN STATE RES FOUND) 4 January 2001

D4: FR-2758431 (Commissariat à l'énergie atomique), 10 July 1998

D5 : US 2002/167280 A1 (ODA ATSUSHI ET AL) 14 November 2002

2.

Claims 22-27 define an electroluminescent device in terms of method steps. It is not clear, firstly, what special device features (structural features) would be imparted by the method steps and furthermore, the formulation of a device in terms of method steps also throws doubt as to the category of the claim (process or device) which thereby renders the claim unclear, contrary to Article 6 PCT.

3.

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 1 is not new in the sense of Article 33(2) PCT.

3.1

Document D1b discloses (the references in parenthesis applying to the figure 3 of this document):

An electroluminescent generating device comprising

- a channel of organic amorphous semiconductor material, Alq3, TFLFL (39 and 36), said channel being able to carry both types of charge carriers, said charges carriers being holes and electrons
- an aluminium electron electrode (33, paragraph 43), being in contact with the channel and positioned on top of the channel, said electron electrode being able to inject electrons in said channel
- an ITO hole electrode (32, paragraph 43), said hole electrode being spaced apart from said electron electrode, said hole electrode being in contact with said channel and positioned on top of the first side of the channel, said hole electrode being able to inject holes into channel
- a control electrode (34) positioned on said first side of said channel

Moreover, document D1b describes a dielectric silicon oxide layer (layer 35, paragraph 50) between the channel and the control electrode, a channel comprising three layers (figure 7, paragraph 67) and a glass substrate.

All features of claims 1-7,9,17,18,21 and 28 are disclosed in D1b, therefore the subject-matter of these claims is not new.

3.2

All standard methods for depositing an organic channel as defined in claims 22-26 or organic device as defined in claims 27 result in an organic EL device which can not be distinguished from a device as disclosed in D1b. Consequently, for the same reasons as paragraph 3.1, claims 22-27 are not novel.

4.

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 8,10,12-16,19 and 20 does not involve an inventive step in the sense of Article 33(3) PCT.

4.1

The subject-matter of claim 8 differs from D1b in that the channel comprises one material selected from tetracene, pentacene, perylene, terthiophene, tetrathiophene, quinquethiophene, sexithiophene, bora-diazaindacene, polyphenylenevinylene, polyfluorene, polythiophene and porphyrins.

However, such features refer to common materials used in an organic light emitting device and are merely one of several possibilities from which the skilled person would select without the exercise of inventive skill (see for instance document D2, page 15, lines 14-17). Therefore the subject-matter of this claim does not involve an inventive step.

4.2

The subject-matter of claim 10 differs from D1b in that the organic semiconductor layer is polycrystalline.

However, it is known in prior art to use, according to the circumstances, either an amorphous or polycrystalline organic semiconductor film in an organic light emitting device (see for instance document D3, paragraph 45).

Therefore the subject-matter of this claim appears to lack an inventive step.

4.3

The subject-matter of claims 12 and 13 differs from D1b in that the hole electrode and the electron electrode are spaced apart at a distance between 5 nm and 5 microns and that the electron and hole electrodes have digitated structures comprising a regular repetition of basic fingers and positioned such that basic finger structures of hole and electron electrodes are alternating each other.

However this electrode configuration refers to a normal choice in an organic electroluminescent device comprising an electron injecting electrode and an hole injecting electrode on the same side of the organic electroluminescent layer.

See for instance document D4, which relates to an organic electroluminescent device comprising an anode and a cathode situated on the same side of the organic electroluminescent material (figure 2) and describes the use of an interdigitated electrodes structure (figure 4, page 3) with a gap size between two electrodes of 1 microns (page 10, line 3).

Therefore, it would be obvious for a skilled person to apply the solution as described in D4 to the device as described in D1b, thereby arriving at the subject-matter of claim 12 and 13.

Consequently, the subject-matter of these claims does not involve an inventive step in the sense of Article 33 (3) PCT.

Moreover, document D4 describes that the distance P and R defined in claim 13 are equal (page 10, lines 2-3).

Therefore, the subject-matter of claim 14 also appears to lack an inventive step.

4.4

The subject-matter of claims 15 and 16 differs from D1b in that the control electrode is positioned on the second side of the channel.

Document D1b describes an organic light emitting device arrangement in a longitudinal direction like a MOSFET (paragraph 24 D1b, D1c) and describes an embodiment with a control electrode deposited on the top of organic channel on the same side as the injection electrodes, which is the corresponding top gate MOSFET structure known in prior art. However, the MOSFET structure comprising a bottom gate structure, the gate electrode being situated under the channel, is also known in the art and is an alternative structure for a MOSFET (see for instance document D5).

Therefore it would be obvious for a skilled person to use the configuration with the control electrode under the organic channel (the embodiment of a bottom-gate MOSFET), the injection electrodes and the control electrode being on both sides, on either side of the organic channel, and consequently no inventive merit can be attributed to the subject-

matter of claims 15 and 16.

4.5

The subject-matter of claims 19 and 20 refers to normal arrangements for an organic light emitting device to enhance the light output (see for instance D6, page 2 and D7, figure 1) and therefore it would be obvious for a skilled person, according to the circumstances, to apply waveguiding layers or a cavity structure to the device as described in D1b without the exercise of inventive skill.

Thus the subject-matter of claims 19 and 20 does not involve an inventive step.

5.

The combination of the features of dependent claim 11 is neither known from, nor rendered obvious by, the available prior art.

The subject-matter of claim 11 differs from D1b in that the organic semiconductor layer is polycrystalline material with a crystal grain size and the hole electrode and electron electrode are spaced apart at a distance smaller than the grain size.

The problem solved by this technical feature can be regarded as how to improve carriers injection in a polycrystalline organic semiconductor layer.

The prior art does not give any indication how to modify the organic light emitting device as described in D1b to get the organic light emitting device of claim 11.

Therefore claim 11 meets the requirements of Article 33(1) PCT.